

# Species of *Cryptochirus* of Edmondson 1933 (Hapalocarcinidae)

R. SERENE<sup>1</sup>

EDMONDSON (1933) describes four new species of *Cryptochirus*: *C. rugosus*, *C. pyriformis*, *C. minutus*, and *C. pacificus*.

Utinomi (1944) considers these four species as synonyms of *C. coralliodytes*. Fize and Serene (1955, 1957), in their studies on the NhaTrang species, point out that they belong to *C. rugosus*, and that this one is a true species, but that it must be referred to the genus *Troglocarcinus*. The question was to know whether three others of Edmondson's species were valid: *C. pyriformis*, *C. minutus*, and *C. pacificus*.

Professor Edmondson very kindly sent me a small collection of Hapalocarcinidae consisting of specimens of those species identified by him. The collection consists of six tubes:

Tube 1, labelled "*Cryptochirus pyriformis* Ed., Washington, August 1924"; with 7 specimens.

Tube 2, labelled "*Cryptochirus minutus* Ed., January 18, 1937; Oahu, Hanauma"; with 13 specimens.

Tube 3, labelled "*Cryptochirus crescentus* Ed., Johnston 1923"; with 2 specimens.

Tube 4, labelled "*Cryptochirus rugosus* Ed., Palmyra Isl., 1923"; with 1 specimen.

Tube 5, labelled "*Cryptochirus* sp. Ed., Rarotonga, 1929; Wilder and Parks"; with 5 specimens.

Tube 6, labelled "*Cryptochirus pacificus* Ed., type"; with 2 specimens.

Tube 6, containing the type (?) of *C. pacificus*, has been given back to Dr. Edmondson. In order to make their study easier, the specimens of the other tubes have been registered under the following numbers:

<i>C. pyriformis</i> Ed.	1 to 6
<i>C. minutus</i> Ed.	7 to 19
<i>C. crescentus</i> Ed.	20 to 21
<i>C. rugosus</i> Ed.	22
<i>C. sp.</i> Ed.	23 to 27

The 27 specimens mentioned above have been referred to species according to this distribution:

Ed. 23, 24, 25, 27: *Cryptochirus coralliodytes* ? (Heller)

Ed. 20, 21: *Troglocarcinus* (*Troglocarcinus*) *crescentus* (Edmondson)

Ed. 22, 26: *Troglocarcinus* (*Favicola*) *rugosus* (Edmondson)

Ed. 1, 2: *Troglocarcinus* (*Favicola*) *belleri* (Fize & Serene)

Ed. 3-6: *Troglocarcinus* (*Favicola*) *pyriformis* (Edmondson)

Ed. 7-19: *Troglocarcinus* (*Favicola*) *minutus* (Edmondson)

Study of the specimens (1) confirms the attachment of *C. rugosus* to the genus *Troglocarcinus* by Fize and Serene (1955); (2) allows the attachment to the same genus of *C. pyriformis* and *C. minutus* also; (3) shows the existence of two distinct species under the name *C. pyriformis*, the other being *T. (F.) belleri* Fize & Serene (1957); (4) does not permit a precise determination of the position of *C. pacificus*.

I recall that, according to Utinomi (1944), the genus *Troglocarcinus* is separated from the genus *Cryptochirus* chiefly by the biramous character of the pleopods on the first pair of the female, while on *Cryptochirus* all of the pleopods of the female are uniramous. In all three species, *C. rugosus*, *C. pyriformis*, and *C. minutus*, those pleopods are biramous, and the attachment of the species to the genus *Troglocarcinus* abolishes any thought of putting them into synonymy with *C. coralliodytes*, according to Utinomi's opinion (1944).

In the same manner Utinomi (1944) had already attached Edmondson's *C. crescentus* to the genus *Troglocarcinus*,<sup>2</sup> which also has the first pleopod biramous in the female. The bi-

<sup>1</sup> Oceanographic Institute of NhaTrang, ViêtNam.  
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<sup>2</sup> Utinomi uses *Pseudocryptochirus* as the name of the genus, but *Troglocarcinus* has priority.

ramous character of the first pleopod of the female is found in two other genera: *Hapalocarcinus* Stimpson and *Pseudohapalocarcinus* Fize & Serene; but those two genera have other specific morphologic characters, and live chiefly in the galls that they form between the branches of corals and not in the galleries hollowed in the coral, as is the case with *Cryptochirus* and *Troglocarcinus*.

In their study of the Hapalocarcinidae of ViêtNam, which distinguishes 22 species, Fize & Serene (1957) define the genus *Troglocarcinus* and separate it from a new genus, *Neotroglocarcinus*, which is characterized by the two first pairs of biramous pleopods on the female. Although all species of *Troglocarcinus* are characterized by the presence of biramous pleopods on the first pair, they are often of various shapes: some have a carapace with a morphology very close to that of *Cryptochirus*, whereas other species have a carapace with a very different morphology. The classification of the genus is reviewed; and the authors divide the genus *Troglocarcinus* into four subgenera, of which the subgenus *Troglocarcinus* (*Favicola*) is used for species which live in hosts belonging to several genera in the subfamilies Faviinae and Montastreinae. The species *T. (F.) minutus*, *T. (F.) pyriformis*, and *T. (F.) helleri*, identified in the present collection, belong in that subgenus. The species of the subgenus *Favicola*, by the morphology of their carapace and of their pereopods, are generally very nearly related to the species of *Cryptochirus* and especially to *C. coralliodytes*. The uniramous or biramous character of the first pleopod of the female is the better character, and provides the clearest, sometimes the only reliable criterion for the differentiation of the genus.

The species *Troglocarcinus* (*Troglocarcinus*) *crescentus*, *T. (F.) rugosus*, *T. (F.) helleri*, and *T. (F.) minutus* are described in detail by Fize and Serene (1957), and it is not necessary to repeat the information on those species. But the carapaces, chelipeds, and pleopods of the first pair, and the third maxillipeds of three last, are illustrated on account of their close relationship with the two parent species and especially with *T. (F.) pyriformis*.

Utinomi (1944) has considered the third

maxillipeds as being a valuable distinctive generic character between *Cryptochirus* and *Troglocarcinus*. He has pointed out that in *C. coralliodytes* the anteroexternal distal border of the merus of the third maxilliped is extended, while it is not extended in *Troglocarcinus crescentus* and *T. viridis*. That character has no value for generic differentiation, since it has been shown that some of the species of *Troglocarcinus* are similarly extended. In fact, the degree of development of that extension is difficult to appreciate on some specimens of *C. coralliodytes*. Therefore this character is not used in descriptions of new species of *Cryptochirus* discussed since Utinomi's work (1944).

The labels on the specimens of the Edmondson collection do not give any references to the host-species of *Hexacorallia* on which the specimens were collected. Therefore the questions of hosts can not be considered in this study, but the importance of hosts will be indicated where it is pertinent.

*Cryptochirus coralliodytes*, Heller 1862

Figs. 1f, 2f, 3a-f, 4a-c, 5H, b, L

*Cryptochirus coralliodytes*, Heller 1862, Akad. Wiss. Math. Nat. Class. Wien. vol. 43, abt. I: 370-371, pl. II, figs. 33-35.

*C. coralliodytes*, Fize & Serene 1957, Mém. Mus. Nat. Hist. Nat. Paris 7è Ser. V (synonymes): 31, fig. 4 A-D, 52 B-E, pl. I B, 3-6, II A, 1-3, X A, XIV A-H.

Tube 5 of Edmondson's collection contained five specimens under the name of *Cryptochirus* spp. Of these, one (Ed. 26) is reported to be *T. (F.) rugosus*. Two others (Ed. 23 and 24) are very small and will not be studied. Ed. 25 is a female, 5.65 mm. in length, and Ed. 27 is a female, 5.55 mm. in length; both are somewhat similar and are characterized by the greater width of the carapace as compared with its length: the ratio is 1.38 to 1.31. They are very strongly convex from front to back, the meeting of two sloping planes, the anterior forward and the posterior backward, making a round angle. On those two specimens, there is a slanting groove separating on each side the median gastric elevation from the epigastric elevations; there are also three pits, or hollows, in lines on

each of the grooves limiting the gastric elevation anterolaterally; and, last, a clearly marked groove delimits anterolaterally the cardio-intestinal elevation. Those details confirm the necessity of a study of the variations of *C. coralliodytes*, because they ally the present specimens to *C. bani*, Fize & Serene 1957. In order to differentiate between *T. (F.) pyriformis* and *C. coralliodytes*, I prefer to refer to another specimen of *C. coralliodytes* (E. 38.795) of the same size of *T. (F.) pyriformis* and borrowed from the collections of the Oceanographic Institute of NhaTrang, rather than use the two specimens of Edmondson (Ed. 25 ad Ed. 27).

*Troglocarcinus (Troglocarcinus) crescentus* (Edmondson 1925)

*Cryptochirus crescentus*, Edmondson 1925, Bernice P. Bishop Mus. Bull. 27: 33-35, fig. 6-A 1, pl. B, C.

*C. crescentus*, Edmondson 1933, Bernice P. Bishop Mus. Occ. Papers 10(5): 16, pl. IV, c-d, Shen 1936, The Hong Kong Natur. Supp. no. 5: p. 21, pl. 2. Hiro 1937, Palao Trop. Biol. Stat. Studies, no. 1: p. 142. Hiro 1938, Zool. Mag. 50(3): 149.

*Pseudocryptochirus crescentus*, Utinomi 1944, Palao Trop. Biol. Stat. Studies 2(4): 687-730; figs. 5-6 (D), 7 (C, F), 10, 11 (H), 12 (C); pl. IV, figs. 7-10, pl. V, fig. 3.

*Troglocarcinus (Troglocarcinus) crescentus*, Fize & Serene 1957, Mém. Mus. Hist. Nat. Paris, 7è Ser. I: 62, figs. 10-11, C, D, 12 B, pls. III B, 4, 7, V, 2, XI B.

The two specimens of the collection which are reported to this species are two females (Ed. 20 and Ed. 21) each 2.5 mm. in length. The species is well described and illustrated by Edmondson (1925, 1933), Utinomi (1944), and Fize & Serene (1957).

It is well characterized both by its habitat (on *Pavona* in holes with lunular apertures) and by its morphology; but its relationship with certain species of *Troglocarcinus*, its great difference from other species of the same genus, and chiefly its relationship with certain species of *Cryptochirus* (such as *C. edmondsoni*), which also lodge on *Pavona* in holes with lunular apertures, call for further observation.

*Troglocarcinus (Favicola) rugosus* (Edmondson 1933)

Figs. 1c, 2c, 5A, a

*Cryptochirus rugosus* Edmondson 1933, Bernice P. Bishop Mus. Occ. Paper 10(5): 6-8, fig. 1 a-h, pl. I A-F.

*Troglocarcinus rugosus*, Fize & Serene 1955, Bull. Soc. Zool. France T. 80, Fasc. 5-6: 381-382.

*T. (Favicola) rugosus*, Fize & Serene 1951, Mém. Mus. Hist. Nat. Paris 7è ser. V: 85, figs. 21-22 A, B, 23 A, 25 A, 27 A-C, pl. V 7, pls. VI A, 1-3, X D, E.

The two specimens of the collection which are reported to this species are Ed. 22, a female 5 mm. in length, and Ed. 26, a female 6 mm. in length. This later specimen came from the tube containing "*Cryptochirus* sp."

The two specimens have these features on the dorsal surface of the carapace: the gastric area, which is swollen, circular, higher, and covered with tubercules; on each side a small higher (epigastric) posterolateral lobe is also covered with tubercules; the transversal groove separating the gastric area from the cardio-intestinal area is marked, but much less so than the grooves which, on each side, separate the posterior part of the gastric elevation and the anterior part of cardio-intestinal elevation from the posterolateral epigastric elevation. Those characters, which are among the most distinct of those of Edmondson's description (1933), are sufficient to define the species, but they can be supplemented with others. In fact, certain specimens of *C. coralliodytes* show some related characters which are almost similar; that explains why Utinomi (1944) puts the species in synonymy with *C. coralliodytes*. Considering that the species is liable to important variations, just as is *C. coralliodytes*, it is therefore convenient to extend the list of characters given by Edmondson (1933) by adding these: (a) the pleopods of the first pair of the female are biramous (Fig. 1c); (b) the anterolateral grooves of the gastric elevation are marked and pigmented in black in the bottom; this is never the case with *C. coralliodytes*; (c) the chelipeds are without any mark of longitudinal pigmented

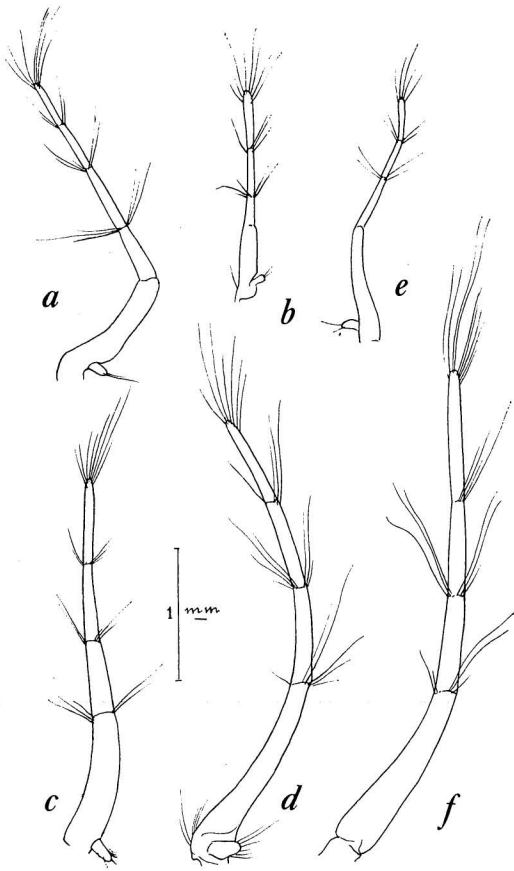


FIG. 1. Pleopods of the first pair on female: *a*, *Troglocarcinus (Favicola) pyriformis*, Ed. 4. *b*, *Troglocarcinus (Favicola) minutus*, Ed. 15. *c*, *Troglocarcinus (Favicola) rugosus*, Ed. 22. *d*, *Troglocarcinus (Favicola) rugosus*, Ed. 26. *e*, *Troglocarcinus (Favicola) helleri*, Ed. 1. *f*, *Cryptochirus coralliodytes*, Ed. 25.

lines which exist generally on *C. coralliodytes*, at least in specimens of the same size; the palms of the chelipeds are elongated, somewhat like those on *C. coralliodytes* (Fig. 5a); (d) the external distal end of the merus of the 3rd maxilliped is without a salient extension (Fig. 2c, d).

The two specimens of the collection are somewhat similar. Ed. 26 offers a very weak spinulation of the anterior part; the spines of the anterolateral borders of the carapace and of the external borders of the antennular basal article especially are very short. On the carapace

the tubercles of the dorsal surface are lightly spinulose and very short; the flatness of the anterior part takes up almost half the length of the carapace; the posterior half of this is very convex in two ways and is obviously widened and swollen in proportion to the anterior and posterior border. The end of anterolateral gastric and epigastric grooves is marked with small chestnut clear spots.

Edmondson (1933) reports the species on *Favia speciosa*; in NhaTrang, it was found chiefly on specimens of the genus *Platygyra*. Fize & Serene (1957) have made a detailed study of it.

*Troglocarcinus (Favicola) helleri*, Fize & Serene 1957

Figs. 1e, 2e, 5B, b

*Troglocarcinus (Favicola) helleri*, Fize & Serene 1957, Mém. Mus. Hist. Nat. Paris 7è ser. V: 93, figs. 23 B, 24, 25 B, 27 D, E, 28 A, pls. V 8, 9, VI B, 4-9, X F, XVI E-G.

The two specimens (Ed. 1 and Ed. 2) of the collection which are reported to this species are both females, both 4 mm. in length.

The species, as described by Fize & Serene (1957), is characterized chiefly by: (1) the strong anterolateral grooves of the gastric elevation, very oblique towards the sides of the carapace (Fig. 5B); (2) the chelipeds with short palms, as high as long (Fig. 5b); (3) a strong spinulation; (4) a gastric elevation, egg-shaped, elongated, very spinulose, and surrounded on each side by epigastric anterolateral and posterolateral lobes, which are very infolded; (5) the posterolateral epigastric lobes of each side which are united behind the gastric elevation and separate this from the cardio-intestinal elevation.

This species, very close to *T. (F.) rugosus*, is distinguished from it chiefly by the height and the colour of the palm of its chelipeds and by the disposition of its gastric and epigastric elevations.

Edmondson has not separated it from *C. pyriformis*, in all probability because of the size of its chelipeds: the short, wide palm is a char-

acter common to those two species, but it separates both of them from *T. (F.) rugosus* as well as from *C. coralliodytes*.

In contrast, the development of the relief and of the spinulation of the dorsal surface of the carapace is very much stronger on *T. (F.) belleri* than on *T. (F.) pyriformis*, and affords sufficient evidence to separate the two species easily.

The two specimens of the present collection are of the same size and are similar, with a very strong spinulation and a very accentuated relief. They have somewhat the size of the type of the species (4 mm.), but some specimens can reach a length of 6 mm. In NhaTrang, it chiefly frequents *Favites abdita*.

*Troglocarcinus (Favicola) minutus* (Edmondson 1933)

Figs. 1*b*, 2*b*, 5*D*, *d*

*Cryptochirus minutus*, Edmondson 1933, Bernice P. Bishop Mus. Occ. Pap. 10 (5): 12-14, fig. 4, pl. 3 E, F.

*Troglocarcinus (Favicola) minutus*, Fize & Serene 1957, Mém. Hist. Nat. Paris 7è, ser. V: 106, figs. 27 F, 28 C, pls. V ii, XVI H, I, K, L.

The collection contains 13 specimens (Ed. 7 to Ed. 19) of which 11 are males and 3 are females.

The species, also found in NhaTrang, is well characterized by: (1) its small size; (2) two deep post-frontal grooves which mark, on the anterior dorsal surface of the carapace, the anterolateral angles of the carapace and the anterolateral angles of the forepart of the gastric elevation (Edmondson, 1933: fig. E, pl. 3); (3) the short and strongly spinous chelipeds (Edmondson, 1933: fig. 4).

On the females, the pleopods of the first pair are biramous (Fig. 1*b*), placing the species in the genus *Troglocarcinus*. The number of eggs is much smaller than that of other species, being usually 20 to 30 instead of 100 to 150, as in other species.

Edmondson (1933) reports finding the species on *Cyphastrea*. It is found on the same host

in NhaTrang. The species, together with *C. coralliodytes*, lives on corals of that genus, but in a form of small size that Fize & Serene (1957) consider as a variety, *C. coralliodytes* var. *parvulus*.

*Troglocarcinus (Favicola) pyriformis* (Edmondson 1933)

Figs. 1*a*, 2*a*, 4*d-f*, 5*E*, *e-G*, *g*

*Cryptochirus pyriformis* Edmondson 1933, Bernice P. Bishop Mus. Occ. Paper, 10 (3): 10-12, fig. 3, pls. 3, 3 A.

The collection contains four specimens: Ed. 3, a female 3.5 mm. in length; Ed. 4, a female 4.1 mm.; Ed. 5, a damaged specimen (female); Ed. 6, a female 3.25 mm. The type specimen, a female of 4 mm., collected from *Favites abdita* on Washington Island by Edmondson (1933), is in the Bishop Museum, in Honolulu. The spec-

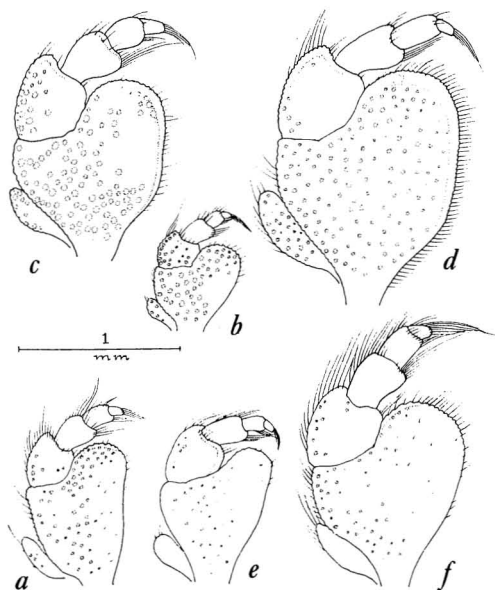


FIG. 2. The third maxillipeds of: *a*, *Troglocarcinus (Favicola) pyriformis*, Ed. 4. *b*, *Troglocarcinus (Favicola) minutus*, Ed. 15. *c*, *Troglocarcinus (Favicola) rugosus*, Ed. 22. *d*, *Troglocarcinus (Favicola) rugosus*, Ed. 26. *e*, *Troglocarcinus (Favicola) belleri*, Ed. 1. *f*, *Cryptochirus coralliodytes*, Ed. 26.

cies is also reported by Edmondson (1933) on *Orbicella curta* and *Hydnophora* sp.

The present specimens are similar to the Edmondson figures and description (1933). However, the tubercles of Ed. 3 are slightly more spinulose than are those of two other specimens. The largest (Ed. 4) is comparatively only slightly larger than two others, with its posterior part more swollen. Without insisting either on the description of present specimens, or their comparison with the Edmondson description and figures (1933), I shall use them to define the situation of the species with regard to species of *Cryptochirus* as well as to related species of *Troglocarcinus* (*Favicola*).

Edmondson (1933) characterizes the species chiefly with regard to *C. rugosus* and *C. pacificus*. He writes: "(1) the chelipeds are relatively larger than on *C. rugosus* and *C. pacificus* and the height of the merus in comparison with its length is larger than on those species. (2) The blunted teeth of the 4th walking legs separate that species from others, too."

In my opinion, the size of *Troglocarcinus* (*F.*) *pyriformis* does not seem to exceed 4 mm., and its small size affords another character, which separates it from those two species which are 6 mm. long. I should mention, further, my doubts about *Cryptochirus pacificus*; that species is not sufficiently defined, as I myself especially know, for I can define the situation of *T. (F.) pyriformis* with regard to it. On the contrary, the separation of *T. (F.) pyriformis* from *T. (F.) rugosus* does not present difficulties. I shall discuss the position of *T. (F.) pyriformis* first with regard to species of *Cryptochirus*, then to species of *Troglocarcinus* (*Favicola*).

#### SPECIES OF *Cryptochirus*

The biramous character of the first pair of pleopods separates *T. (F.) pyriformis* from all of the other species of *Cryptochirus*; the bigger size of the palm of its chelipeds separates it from *C. coralliodytes*, with which Utinomi (1944) puts it in synonymy. But some other characters in the description by Edmondson (1933) of *C. pyriformis*, and which are found on specimens of the present collection, are not much different from those of certain specimens

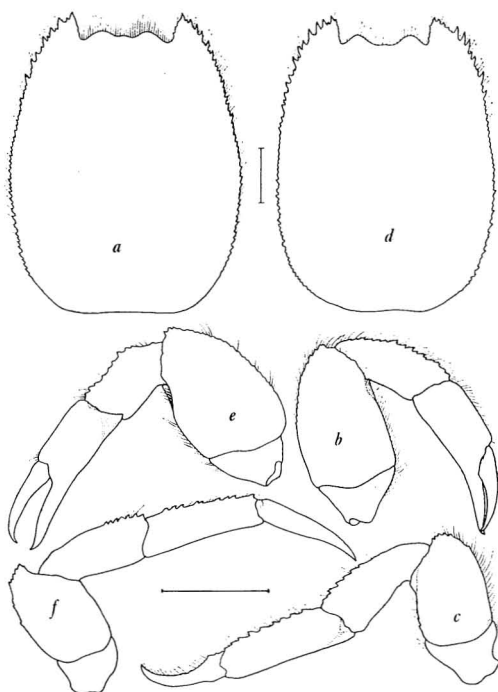


FIG. 3. *Cryptochirus coralliodytes*: (Ed. 25) 5.6 mm: a, Carapace; b, left cheliped, internal face; c, pereiopod 5 left, external face; (Ed. 27) 5.6 mm.: d, Carapace; e, cheliped right, internal face; f, pereiopod 5 right, external face.

of *C. coralliodytes*. In fact, that last species is liable to very many variations, which unfortunately are not yet the object of sufficient studies. In the present state of my observations, those variations would be related to various factors, among them the species of *Hexacorallia* hosts and the age (size) of specimens. Those factors do not have absolute value because there exist, if not the species, at least the varieties or the dwarf races of *C. coralliodytes*, and the species *sensu largo* inhabits numerous species of the various genera of *Hexacorallia*.

The specimen Ed. 4 (4 mm. long) of *T. (F.) pyriformis* is compared (Fig. 4, a-f) with a specimen of *C. coralliodytes* (E. 38.795) of exactly the same size, taken from NhaTrang bay, and now in the collection of the Oceanographic Institute of NhaTrang.

The carapace of the second specimen is comparatively: (1) more spinulose; especially, the



teeth of the anterolateral borders are much longer and sharper; (2) narrower, (that of *T. (F.) pyriformis* being wider at the posterior third). In dorsal view the outline of the carapace of the two species is different: the lateral borders are more convex on *T. (F.) pyriformis*, straighter on *C. coralliodytes*. The anterior border is narrower on *T. (F.) pyriformis*; it is chiefly the frontal margin (properly so called) which is shorter. That character of the outline of the carapace agrees with the meaning of the name "*pyriformis*" given to the species; but this does not mean that the carapace can not be capable of showing variations in a series of individuals. Moreover, perhaps certain specimens of *C. coralliodytes* can show similar variations in shape.

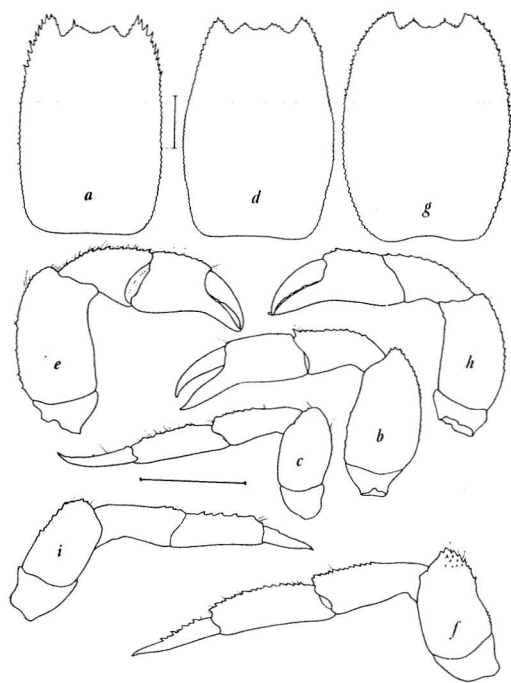


FIG. 4. *Cryptochirus coralliodytes* (E. 38.795) 4.1 mm.: a, Carapace; b, right cheliped, internal face; c, pereopod 5 left, external face. *Troglocarcinus (Favicola) pyriformis* (Ed. 4) 4.1 mm.: d, Carapace; e, left cheliped, internal face; f, pereopod 5 left, external face. *Troglocarcinus (Favicola) verrilli* (E. 39.000) 4.2 mm.: g, Carapace; h, right cheliped, internal face; i, pereopod 5 right, external face.

Comparisons of the chelipeds and the 5th pereopods are presented in Table 1. Measurements of length were taken on the upper margin in a straight line between the two extremities; the figures given for height are those obtained at the largest place on the structure being measured.

These measurements show that, as far as the chelipeds are concerned, the wrist is higher and the propodus is shorter and higher on *T. (F.) pyriformis*. One knows that the prolongation of the wrist, propodus, and dactylus of the cheliped shows some individual variations in *C. coralliodytes*, but in that species the prolongation is always much more accentuated than it is in *T. (F.) pyriformis*. The short and squat shape of the wrist and propodus of *T. (F.) pyriformis* affords a good character for distinguishing it from *C. coralliodytes*, at least in the present state of our knowledge of the variations exhibited by the latter species. Therefore, observations upon the sizes of the articles of chelipeds require more precision. Edmondson (1933) in describing *T. (F.) pyriformis* said only this: "fingers as long as palm, which is about one half the length of the carpus." On the specimens of the present collection, the palm is shorter than the finger, the length of the wrist being nearly twice the length of the palm, but less than twice the length of the dactyle. Edmondson (1933) also noted that, on *T. (F.) pyriformis*, the height of the merus in comparison with its length is larger than on *T. (F.) rugosus* and *C. pacificus*. On *C. pyriformis* that measurement is similar to the measurement of *C. coralliodytes*. In summary, on *C. pyriformis* the merus is similar, the wrist higher, the propodus shorter and higher, than on *C. coralliodytes*.

Edmondson (1933) also characterized *T. (F.) pyriformis* by the blunted teeth which garnish its 5th pereopod. This character is very clear on the specimen (Ed. 4), especially with the presence of spinules on the dactylus which are missing on the *C. coralliodytes* of the same size. But the measurements show another differential character between the two species: The entire 5th pereopod is longer on *T. (F.) pyriformis* than it is on *C. coralliodytes* (3.92 mm. com-

TABLE 1

COMPARISON OF THE CHELIPEDS AND OF THE FIFTH PEREIOPODS IN *C. pyriformis* AND *C. coralliodytes*  
(All measurements are in mm. L=length; H=height.)

	<i>C. pyriformis</i>		<i>C. coralliodytes</i>		
	Ed. 4	Ed. 3	E. 38.795	Ed. 27	Ed. 25
Carapace:					
length	4.10	3.25	4.10	5.55	5.65
width	2.85	2.07	2.70	4.00	4.30
Cheliped:					
merus L.	1.30	1.10	1.30	1.42	1.37
merus H.	0.70	0.60	0.70	0.92	0.82
carpus L.	0.90	0.77	0.90	0.92	1.10
carpus H.	0.55	0.40	0.45	0.50	0.45
propodus L.	0.55	0.40	0.60	0.70	0.70
propodus H.	0.62	0.42	0.45	0.45	0.45
dactylus L.	0.67	0.55	0.65	0.80	0.80
dactylus H.	0.16	0.15	0.20	0.22	0.15
5th Pereiopod:					
merus L.	1.00	0.80	0.82	0.95	1.15
merus H.	0.64	0.47	0.40	0.70	0.70
carpus L.	1.10	0.90	0.85	1.17	1.15
carpus H.	0.45	0.30	0.32	0.45	0.47
propodus L.	1.00	0.70	0.80	1.00	1.05
propodus H.	0.40	0.30	0.30	0.40	0.45
dactylus L.	0.82	0.65	0.70	1.00	0.77
dactylus H.	0.20	0.17	0.17	0.20	0.25

pared with 3.17 mm.), each of the articles—merus, carpus, propodus, dactylus—is longer on the first species. These two characters of the 5th pereiopod of *T. (F.) pyriformis*—its being longer and more spinulose than *C. coralliodytes*—are very distinct with regard to our specimen (E. 38.795) of the same size.

Therefore, one can conclude from the comparison of Ed. 4 with E. 38.795, that *T. (F.) pyriformis* is separated from *C. coralliodytes* by: (1) the carapace of different shape, more elongated at the posterior one third, narrower on the anterior border, with a smaller development of the spinulation of the anterolateral borders; (2) the chelipeds with higher wrist and propodus; (3) the 5th pereiopods being longer and more spinulose, with spinules on the dactylus.

The *T. (F.) pyriformis* (Ed. 4) is compared with two much larger specimens of *C. coralliodytes* of the present collection (Ed. 26 and Ed. 27). The ratio of the width to the length of the carapace does not afford a distinct character of difference:

- 1.43 mm. on Ed. 4, *T. (F.) pyriformis*, (4 mm. in length)
- 1.51 mm. on E. 38.795, *C. coralliodytes*, (4 mm. in length)
- 1.38 mm. on Ed. 27, *C. coralliodytes*, (5.55 mm. in length)
- 1.31 mm. on Ed. 25, *C. coralliodytes*, (5.65 mm. in length)

But on the chelipeds, the height of the wrist and the propodus is always less than it is on *T. (F.) pyriformis*; on this species, the length of the 5th pereiopod is always relatively shorter, the whole length of the carpus, propodus, dactylus, measured from the upper margin of the carpo-meral articulation to the distal end of the dactylus, is 2.9 mm. on Ed. 4 and 2.2 mm. on E. 38.795 of the same size; but only 2.9 mm. on Ed. 26 and Ed. 27 which are much larger in size. And finally, the spinulation is much smaller on the three specimens of *C. coralliodytes* than on Ed. 4.

*T. (F.) pyriformis* is also separated by the wide palm of its cheliped from *C. nami* and *C.*



*bani*, two species of *Cryptochirus* related to *C. coralliodytes* (which inhabits the Astreidae hosts). *T. pyriformis* is separated without difficulty from *C. tri* and *C. edmondsoni*, which inhabit Hexacorallia of different families, the first on hosts of the genus *Echinopora*, the latter on hosts of *Pavona* and *Psammocora*.

#### SPECIES OF *Troglocarcinus*

The inclusion of *C. pyriformis* in the subgenus *Troglocarcinus* (*Favicola*) has been mentioned above. That subgenus now contains *T. (F.) rugosus*, *belleri*, *verrilli*, *pyriformis*, and *minutus*. The first species reaches a size of 9 mm., the second of 6 mm.; the three others are smaller and do not exceed 5 mm. in length. All inhabit hosts in the subfamilies Faviinae and Montastreinae.

*T. (F.) pyriformis* is separated from *T. (F.) rugosus* by: (1) the different shape of the outline of the carapace; (2) the relief of the carapace with its very deep grooves and spinulation; (3) the wrist and the propodus of the chelipeds, which are shorter and higher.

*T. (F.) pyriformis* is separated from *T. (F.) belleri* as well as from *T. (F.) rugosus* by the first two characters just mentioned, but it shares the third character with *T. (F.) belleri*. Perhaps, this is the reason why Edmondson, in the present collection, has not separated the two species. Given the difference in size of the specimens of the two species, one could think that *T. (F.) pyriformis* is a young form of *T. (F.) belleri*, considering as a character of youth the smaller relief and the weaker spinulation of the carapace. The specimens of *T. (F.) belleri* of the present collection (Ed. 1 and Ed. 2) have precisely the same size (4 mm.) as do the specimens of *T. (F.) pyriformis*, and no confusion is possible between them.

*T. (F.) pyriformis* is separated from *T. (F.) minutus* by the shape and weak spinulation of carapace and chiefly by its relief, which is not

much marked, whereas *T. (F.) minutus* is well characterized by its gastric anterolateral grooves, which are wide and deep.

It is with *T. (F.) verrilli* that *T. (F.) pyriformis* is most closely related, generally having in common with it (1) a small size; (2) the weak relief and spinulation of its carapace; (3) the height of the propodi of the chelipeds.

Comparison of *pyriformis* (Ed. 4) with a specimen of *verrilli* (E. 39.100) of almost the same size (4.35 mm.) from the collection of the Oceanographic Institute of NhaTrang, shows that the first species is separated from the second by: (1) the different shape of the outline of the carapace, which on the second has its lateral borders more regularly convex from front to backward (Fig. 4g); (2) a larger space between the anterior end of the anterolateral angles of the carapace (Fig. 4g); in the second species, if the frontal margin properly so called (between the internal supraorbital angles) is as wide as in the first, the external orbital angles are nearer; (3) a stronger anteroposterior convexity of the dorsal surface; in the second species, the opposition between the anterior plan, which is sloping frontwards, and the posterior plan, which is sloping backwards, is much less accentuated; the species is more flattened dorsoventrally; (4) the chelipeds are comparatively shorter and higher, the morphology of wrist, propodus, and dactylus of *verrilli* is medium in its size between *T. (F.) pyriformis* and *C. coralliodytes* (Fig. 4b); (5) the 5th pereopod is comparatively longer and more spinous, especially on *T. (F.) verrilli*: the whole length of carpus-propodus-dactylus is much shorter than on *T. (F.) pyriformis*. Edmondson uses that character of the 5th pereopod in order to define *C. pyriformis*, and I have observed it myself. But in the present state of our knowledge, I am not sure of its worth as a character of specific differentiation: it is possible that it is liable to individual variation within a species.

FIG. 5. Carapaces and chelipeds of: A,a, *Troglocarcinus (Favicola) rugosus* (E. 39.108) 8 mm.; B,b, *Troglocarcinus (Favicola) belleri* (E. 38.677) 6 mm.; C,c, *Troglocarcinus (Favicola) verrilli* (E. 39.100) 4.2 mm.; D,d, *Troglocarcinus (Favicola) minutus* (Ed. 15) 2.5 mm.; E,e, *Troglocarcinus (Favicola) pyriformis* (Ed. 6) 3.25 mm.; F,f, *Troglocarcinus (Favicola) pyriformis* (Ed. 3) 3.5 mm.; G,g, *Troglocarcinus (Favicola) pyriformis* (Ed. 4) 4.1 mm.; H,h, *Cryptochirus coralliodytes* (E. 38.795) 4 mm.; K,k, *Cryptochirus bani* (E. 38.727) 6.5 mm.; L, *Cryptochirus coralliodytes* (Ed. 27) 5.6 mm.; M, *Cryptochirus pacificus* Edmondson, 4 mm.



*Cryptochirus* ? *Pacificus* ? Edmondson 1933

Fig. 5M

*Cryptochirus pacificus* Edmondson 1933, Bernice P. Bishop Mus. Occ. Pap., 10 (5): 8-10, fig. 2 a-j, pl. II.

The sixth tube in the Edmondson collection contained two female specimens under the name "*C. pacificus*." Both were in bad condition, having lost their legs. One specimen has only its carapace without abdomen; the other has both carapace and abdomen, but the two parts are separated. Neither on the abdomen, nor on the carapace, can I find a trace of the first pair of pleopods, observation of which could permit a determining whether it is a *Troglocarcinus* or a *Cryptochirus*. On the abdomen, the 2nd and 3rd pairs of pleopods are still present.

Edmondson (1933) places the species as closely related to *C. rugosus* but more smooth on the carapace and its appendices. Moreover, according to him the median border of the ischium of the 3rd maxilliped is strongly convex, while it is straighter on other species. But reference to Edmondson's description and figures (1933) shows that the species is different from *T. (F.) rugosus*, *belleri*, *verrilli*, *pyriformis*, and *minutus* as described by Fize & Serene (1957).

On the contrary, it closely resembles *C. coralliodytes* and, more particularly, *C. bani*. The apparent relationship between *C. bani* and *C. pacificus* caused me to ask Dr. Edmondson to send me his specimens of *C. pacificus* in order to permit me to make a comparison. Their relationship is discussed in the following observations.

(1) The type of *C. pacificus* is 8 mm. long (Edmondson 1933) and this agrees with the size of *C. bani*.

(2) Edmondson's descriptions and figures of the species agree rather well with the morphology of *C. bani*, especially in: (a) the sloping anterior part of the dorsal surface of the carapace, the V-shaped elongated depressions on each side of the median line; and (b) the crescent-shaped depression with posterior concavity which separates the cardiac and gastric regions.

(3) Edmondson obtained his specimens on *Favia* sp. and *Meandra* (= *Platygyra*) *lamellina*;

and Fize & Serene (1957) collected *C. bani* on *Favia speciosa*.

Those authors also collected *C. coralliodytes* var. *rubrolineata* on *Platygyra lamellina*. This variety is very near to *C. bani*, at least by reason of its large size. *C. pacificus* is very nearly related to these last two forms, very close between them. Perhaps all three of them are really only different forms of the same species.

*C. pacificus* is not much different from *C. bani* except that, in *pacificus*, the flattening of the sloping posterior part is clearly longer than the flattening of the anterior part. Just the contrary picture is shown by *C. bani*: the flattening of the anterior part extends as far as the groove which separates the cardiac and gastric regions, and the posterior part is shorter than the anterior. The *C. coralliodytes* (Ed. 27) of the present collection is not very different from these forms, but is not as distinctly marked on the sloping anterior part of the carapace by the V-shaped elongated depression mentioned by Edmondson (1933) on *C. pacificus*, which depression is found on *C. bani* also. To me that character does not seem to be sufficient for differentiating *C. pacificus* from *C. bani*, or from *C. coralliodytes* var. *rubrolineata*, or from *C. coralliodytes*. That depression, by its internal branch, leads to a groove, which separates anterolaterally the advancing of the gastric elevation towards the anterior border of the postero-orbital elevation, extending backwards the upper-internal angle of orbit; and, by its external branch, it leads to a groove, which separates the same elevation posterolaterally from the hepatic region of anterolateral borders. The more or less large producing of the branches of that V-shaped depression, its more or less accentuated reliefs, seem to me to suggest the possibility of individual variations of *C. coralliodytes*, which is not yet so well known. The same is true for the more or less great development of the crescent-shaped depression with a posterior concavity which marks the separation of the gastric and the cardio-intestinal regions. Perhaps the same is true for the variations in proportion between the anterior part sloping frontwards and the posterior part sloping backwards; and for the more or less great height of the carapace in proportion to its length, the more or less great

flattening of the posterior part. These are characteristics that the profiles of carapaces figured by Edmondson (1933) show clearly, and they reveal the differences between *C. pacificus* and *C. coralliodytes*.

It is proper, while we are discussing that subject, to point out the insufficient exactitude of the proportions in the outlines of the carapaces on the figures of Edmondson (1933), especially in figure 2 of *C. pacificus*. The ratio of the width of the carapace to its length, measured in that figure, is 1.78 while it is 1.32 in the other figure (Edmondson, 1933: pl. 2B). The latter ratio is approximately that found in *C. bani* and *C. coralliodytes* specimens of the same size, where it changes between 1.25 and 1.35. The figure of the male of *C. pacificus* suggests the idea of its close relationship to *C. coralliodytes*. Therefore, I think that *C. pacificus* as defined by Edmondson (1933) is near *C. bani* or *C. coralliodytes* var. *rubrolineata*, and perhaps in consideration of its large size is a form of *C. coralliodytes*.

Unfortunately the two specimens of *C. pacificus* which Dr. Edmondson sent to me do not allow me either to contradict or to confirm my impression. I have already mentioned their bad condition. But the larger specimen was only 4 mm. long, and that makes me doubt, in spite of the label, that it is the type to which Edmondson (1933) attributed a length of 8 mm. In order to define with certainty the characteristics of that species, specimens of 8 mm. must be observed and compared with specimens of the same size of *C. bani* and *C. coralliodytes*. Observations upon the pleiopods of the first pair, in female specimens, can also place the taxonomy of the species in a better perspective.

#### SUMMARY

Edmondson (1933) described four new species of *Cryptochirus* from the Hawaiian Islands: *C. rugosus*, *minutus*, *pyriformis*, and *pacificus*. Utinomi (1944) believed that these four species are only variations of *Cryptochirus coralliodytes*, and must be put in synonymy with that species. Fize and Serene (1957), in a revision of the Hapalocarcinidae, proposed a separation between the genus *Cryptochirus* and the genus

*Troglocarcinus*, and pointed out that *C. rugosus* Edmondson 1933 and *C. minutus* Edmondson 1933 must be referred to the subgenus *Troglocarcinus* (*Favicola*).

The collection discussed in this paper was sent to the author by Professor Edmondson. Study of its specimens proved that *C. pyriformis* Edmondson 1933 should also be referred to *Troglocarcinus*. The bad state of preservation of the specimens does not permit a determination of the position of *C. pacificus* Edmondson 1933.

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